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FINAL REPORT ON STRATEGIC PETROLEUM RESERVE CRUDE OIL DATA SEARCH FILE DOCUMENTATION

AFLRL REPORT No. 107

by

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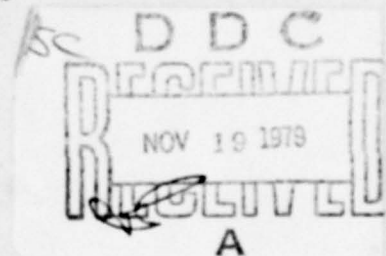### Interagency Agreement No. EL-78-A-01-2815

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Crude oil analysis data for the years 1950-1977 were obtained on magnetic tape from the DOE Bartlesville Energy Technology Center and placed on the DOE Energy Information Administration's computer for use by the DOE Strategic Petroleum Reserve Office (SPRO). A data transformation program was written to convert the crude oil data to a new SPRO crude oil data file compatible with SPRO crude oil purchase specifications. This SPRO crude oil data file is searchable for the purposes of ———→ over

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20. ABSTRACT

identifying and locating crude oils having properties within specified
search limits.

FOREWORD

This document is the final report for Task 3 of a 4-task program, which was conducted at the U.S. Army Fuels and Lubricants Research Laboratory (USAFLRL) at Southwest Research Institute, San Antonio, Texas, under Contract DAAK70-78-C-0001, during the period June 1978 through September 1979. The work was funded through Interagency Agreement EL-78-A-01-2815 between the Department of Energy and the Department of Defense. The contract monitor was Mr. F.W. Schaekel of the Energy and Water Resources Laboratory, U.S. Army Mobility Equipment Research and Development Command, DRDME-GL, Ft. Belvoir, VA.

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TABLE OF CONTENTS

LIST OF TABLES

I. INTRODUCTION AND BACKGROUND

The Army's original "Crude Oil Characterization Data Program"[1]* used crude oil analysis data from the Bureau of Mines [now Department of Energy (DOE)] Bartlesville Energy Technology Center. The data were stored on a commercial time-shared computer facility. This crude oil characterization data program enabled its users to search the data base for crude oils with certain characteristics. However, the data for this program contained only 800 crude oil analyses. A project task was initiated in the third quarter of 1978, through a DOE to DOD Interagency Agreement to establish the data base in the DOE Energy Information Administration's computer facility and to update and expand the data base.

One phase of this task involved comparing the format of the customary Bureau of Mines (BOM) crude oil assay with the purchase specifications in Table 1 currently used by the Strategic Petroleum Reserve Office (SPRO), and resolving format incompatibilities. This new data base was to include nearly 3500 samples covering the years 1950 forward.

II. DISCUSSION

The basic crude oil data for the program was obtained from the DOE Bartlesville Energy Technology Center's (BETC) analyses of crude oils for the years 1950 to 1977, some of which have been published.[2,3] These data contain the information shown in Table 2 for each individual crude oil.

The serialized crude oil data file organization and data for Sample No. 69001 are provided in Table 2. The data as configured in Table 2 were transmitted to SPRO and stored on magnetic tape. The data were placed in file CN6086.-PRJ.BOMTAPE.YR5077 on the Energy Information Administration's computer. The data in this form were not suitable for direct search using the SPRO specifications as shown in Table 1. A new file called CN6086.RE5.SPRO.SEILE, refer-

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* Superscript numbers in parentheses refer to the List of References at the end of this report.

5

TABLE 1. CURRENT SPRO CRUDE OIL SPECIFICATIONS

Characteristic	SPRO Crude Oil Type					
	I	II	III	IV	V	VI
API Gravity (°API)	30–36	40–45	30–36	34–40	36–40	26–30
Total Sulfur (wt%) max	1.99	0.25	0.50	0.25	0.50	1.25
Pour Point (°F) max	50	50	50	50	50	50
Salt Content, (Lb/1000 Bbl) max	50	50	50	50	50	50
Viscosity (SUS @ 60°F) max	150	150	150	150	150	200
Reid Vapor Pressure (psig @ 100°F) max	11	11	11	11	11	11
Mercaptans (ppm in 375°–500°F fraction) max	No limit	12	12	12	No limit	12
Yields (vol%) Naphtha (< 375°F)	24–30	35–42	21–29	29–36	30–38	15–20
Distillate (375°–620°F)	17–31	21–35	23–37	31–45	19–33	24–27
Gas Oil (620°–1050°F)	26–38	20–34	28–42	20–34	23–37	38–42
Residuum (> 1050°F)	10–19	4–9	7–14	0–5	7–14	15–20
Water and Sediment (vol%) max	1.0	1.0	1.0	1.0	1.0	1.0

Line Number	Description	Alpha-Numeric Data for Sample #69001
Line 1		
1.	Sample Identification	69001.00
2.	Location Code	35.000
3.	Gravity, specific	0.832
4.	Sulfur Percent	0.200
5.	Nitrogen, Percent	0.049
6.	Pour Point, °F	-5.000
7.	S U S Viscosity at 100°F	43.000
Line 2		
1.	Carbon residue of crude, percent	0.900
2.	Sulfur residue	0.000
3.	Nitrogen Residue	0.000
4.	Light gasoline, percent	6.500
5.	Total gasoline and naphtha, percent	28.200
6.	Kerosine distillate, percent	10.300
7.	Gas Oil, percent	13.917
Line 3		
1.	Nonviscous lubricating distillate, percent	11.886
2.	Medium lubricating distillate, percent	6.397
3.	Viscous lubricating distillate, percent	0.000
4.	Distillation loss, percent	2.600
5.	Residuum, percent	26.700
6.	County Code	113.000
7.	Depth	2700.000
Line 4		
1.	Field name	Burbank
2.	Geologic formation (AAPG Mnemonic code)	CMPS
3.	LQ - Integer	0
4.	LQ - Octal	0
Line 5		
1.	Percent at cut 122°F mm Hg atmospheric	1.4
2.	Percent at cut 167°F mm Hg atmospheric	1.6
3.	Percent at cut 212°F mm Hg atmospheric	3.5
4.	Percent at cut 257°F mm Hg atomspheric	5.6
5.	Percent at cut 302°F mm Hg atmospheric	5.3
6.	Percent at cut 347°F mm Hg atmospheric	5.3
7.	Percent at cut 392°F mm Hg atmospheric	5.5
8.	Percent at cut 437°F mm Hg atmospheric	4.9
Line 6		
1.	Percent at cut 482°F mm Hg atmospheric	5.4
2.	Percent at cut 527°F mm Hg atmospheric	4.9
3.	Percent at cut 392°F at 40 mm Hg (585°F atmospheric)	3.8
4.	Percent at cut 437°F at 40 mm Hg (636°F atmospheric)	6.3
5.	Percent at cut 482°F at 40 mm Hg (687°F atmospheric)	6.1
6.	Percent at cut 527°F at 40 mm Hg (737°F atmospheric)	5.5
7.	Percent at cut 472°F at 40 mm Hg (787°F atmospheric)	5.6

Line Number	Description	Alpha-Numeric Data for Sample #69001
Line 7		
1.	Specific gravity 60/60°F at 122°F atmospheric	0.633
2.	Specific gravity 60/60°F at 167°F atmospheric	0.674
3.	Specific gravity 60/60°F at 212°F atmospheric	0.709
4.	Specific gravity 60/60°F at 257°F atmospheric	0.734
5.	Specific gravity 60/60°F at 302°F atmospheric	0.753
6.	Specific gravity 60/60°F at 347°F atmospheric	0.772
7.	Specific gravity 60/60°F at 392°F atmospheric	0.790
8.	Specific gravity 60/60°F at 437°F atmospheric	0.804
Line 8		
1.	Specific gravity 60/60°F at 482°F at 40 mm Hg	0.817
2.	Specific gravity 60/60°F at 527°F at 40 mm Hg	0.828
3.	Specific gravity 60/60°F at 392°F at 40 mm Hg	0.846
4.	Specific gravity 60/60°F at 437°F at 40 mm Hg	0.854
5.	Specific gravity 60/60°F at 482°F at 40 mm Hg	0.865
6.	Specific gravity 60/60°F at 527°F at 40 mm Hg	0.874
7.	Specific gravity 60/60°F at 572°F at 40 mm Hg	0.882
Line 9		
1.	Specific gravity 60/60°F of residue at 40 mm Hg	0.923
2.	S U S Viscosity for fractions at 392°F at 40 mm Hg	40.000
3.	S U S Viscosity for fractions at 437°F at 40 mm Hg	46.000
4.	S U S Viscosity for fractions at 482°F at 40 mm Hg	58.000
5.	S U S Viscosity for fractions at 527°F at 40 mm Hg	81.000
6.	S U S Viscosity for fractions at 572°F at 40 mm Hg	135.000
7.	Cloud test for fraction at 392°F at 40 mm Hg	10.000
Line 10		
1.	Cloud test for fraction at 437°F at 40 mm Hg	30.000
2.	Cloud test for fraction at 482°F at 40 mm Hg	55.000
3.	Cloud test for fraction at 527°F at 40 mm Hg	75.000
4.	Cloud test for fraction at 572°F at 40 mm Hg	90.000
5.	Specific gravity of light gasoline	0.684
6.	Specific gravity of total gasoline and naphtha	0.744
7.	Specific gravity of kerosine distillate	0.811
Line 11		
1.	Specific gravity of gas oil	0.842
2.	Start of calculated specific gravity range for nonviscous lubricating distillate	0.858
3.	Start of calculated specific gravity range for medium lubricating distillate	0.877
4.	Start of calculated specific gravity range for viscous lubricating distillate	0.886
5.	End of calculated specific gravity range for viscous lubricating distillate	0.000
6.	S U S Viscosity at 77°F	51.000
Line 12		
	Blank	

8

red to as the SPRO Search File, was generated from the Table 2 formatted data for use in SPRO crude oil searches.

The SPRO Search File was organized for each crude oil according to key items listed in Table 3, which also gives the file line and column numbers.

TABLE 3. SPRO SEARCH FILE ORGANIZATION BY LINE AND COLUMN

Item	Description	Line	Columns
A	Sample ID	1	3-11
B	API Gravity at 60°F	1	12-20
C	Weight % Sulfur Content	1	21-29
D	Pour Point, °F	1	36-39
E	SUS Viscosity at 100°F	1	40-48
F	SUS Viscosity at 77°F	1	49-57
G	SUS Viscosity at 60°F	1	58-66
H	Weight % Estimated Asphalt	2	3-11
I	% Naphtha (< 375°F)	2	12-20
J	% Distillate (375°-620°F)	2	21-29
K	% Gas Oil (620°-1050°F)	2	30-38
L	% Residuum (> 1050°F)	2	39-47
M	Location Code	2	48-56
N	Field Name	3	3-18
O	Comment	4	All

In generating the SPRO Search File from the BETC crude oil data file, some items are used directly while others must be calculated. The method used to modify the data from the file and some supporting data are discussed below according to the item letter in Table 3.

● Item A: Sample ID is taken directly from BETC data. The first two digits indicate the year the analysis was performed. These two digits are followed by a three-digit sequence which starts at 001 for each year.

● Item B: API Gravity at 60°F is a special function of specific gravity. The specific gravity at 60°F taken from the BETC data was converted to API gravity using the equation:

$$API = (141.5/sp. \ gr. \ 60/60°F) - 131.5.$$

9

● Item C: Total Sulfur is the weight percent sulfur in the crude oil taken directly from BETC data.

● Item D: Pour Point °F is taken directly from BETC data. A "less than" symbol indicates the actual value is below the reading reported (i.e., <5 = below 5 degrees).

● Item E: SUS Viscosity at 100°F is taken directly from BETC data.

● Item F: SUS Viscosity at 77°F is taken directly from BETC data when available.

● Item G: SUS Viscosity at 60°F is calculated from the SUS viscosities at 100° and 77°F using the mathematical relationships presented in the ANSI/ASTM D 341-77 method entitled "Standard Viscosity-Temperature Charts for Liquid Petroleum Products."

The basic equation for the method is:

$$\log \log (v + 0.7) = A - B \log T$$

where:

v = kinematic viscosity, cSt
log = logarithm to base 10
T = temperature, °F
A & B = constants.

This calculation method requires kinematic viscosities. The conversion between SUS and kinematic viscosity is made using the ANSI/ASTM D 2161-74 method entitled "Standard Method for Conversion of Kinematic Viscosity to Saybolt Universal Viscosity or to Saybolt Furol Viscosity."

Some of the crudes in the data base have a viscosity reading reported at 100°F but not at 77°F. For these crudes, the 60°F viscosity is calculated using the following formula:

10

$$\text{VIS60} = 10**(10**((\log \log \text{VIS100}) + 0.06))$$

where:

VIS60 = viscosity, SUS at 60°F

VIS100 = viscosity, SUS at 100°F

** = exponential

log = logarithm to base 10.

This equation contains a constant which was determined using a limited set of crude oil sample data as given in Table 4. Calculated viscosities at 60°F using this equation compared favorably with those determined using the ASTM D 341 method, provided the samples had pour points of less than 50°F and viscosities at 60°F of less than 150 SUS.

There are some instances (less than 1%) where there are no 77°F or 100°F viscosity values for a crude. In these cases, the viscosity values for the crude are reported as all zero and should be ignored. Finally, it is possible, using the above calculations, for a crude to have an apparent finite 60°F viscosity when its pour point is 60°F or higher. Although there is no computer program check for this, any crude having a pour point of 55°F or higher would be eliminated in a SPRO search because the upper pour point limit for acceptable crudes is 50°F.

● Item H: Weight % Estimated Asphalt is calculated by multiplying 4.9 times the Conradson carbon residue (% wt) of the entire crude, which is available from the BETC data.

● Item I: % Naphtha is the less than 375°F cut of the crude. This value is obtained from the summation of the 122°, 167°, 212°, 257°, 302°, and 347°F BETC cuts plus an interpolation of the 347°-392°F cut.

● Item J: % Distillate is the 375° to 620°F cut of the crude. This value is obtained from the summation of the 437°, 482°, 527°, and 585°F (atmospheric equivalent temperature) BETC cuts plus interpolations of the 347°-392°F and 588°-636°F (atmospheric equivalent temperature) cuts.

11

TABLE 4. VISCOSITY AND BOILING POINT CALCULATION DATA

Item No.**	Viscosity, SUS 77°F	100°F	130°F	Calculated 60°F Viscosity SUS Equation*	ASTM D 341	Pour Point °F	% Off at B.P. 687°F	737°F	787°F	% Off Slope	Extrapolated 787°F to 1050°F cut	Total % off at 1050°F by extrapolation	Correlation derived total % off at 1050°F
1	77	69	---	129	86	5	7.0	7.7	7.0	0.14	36.82	103.72	86.0
3	34	33	---	55	35	5	4.9	4.0	5.0	0.1	26.3	82.1	94.83
5	58	45	---	79	82	5	6.4	5.9	5.0	0.1	26.3	100.0	89.14
7	---	410	190	1000	1600	50	6.3	5.7	6.9	0.138	36.294	87.19	78.61
9	77	60	---	110	100	40	5.2	4.9	5.7	0.114	29.982	93.28	85.17
10	---	300	155	698	900	40	5.1	5.4	7.0	0.14	36.82	90.92	80.22
11	45	39	---	67	54	5	6.1	5.1	---	---	---	---	88.59
12	---	130	84	267	300	40	5.6	9.3	5.2	0.104	27.352	82.95	80.87
13	---	131	86	270	310	55	6.2	5.2	6.9	0.138	36.294	97.59	83.27
14	---	304	138	709	1300	25	6.6	6.6	---	---	---	---	77.63
15	102	78	---	149	145	15	5.4	5.5	5.7	0.114	29.982	108.68	81.38
17	48	40	---	69	60	5	4.5	4.4	5.1	0.102	26.826	101.02	91.96
19	42	41	---	71	43	5	7.0	5.7	7.9	0.158	41.554	110.05	90.81
21	82	56	69	102	138	55	6.5	6.7	6.7	0.134	35.242	94.94	87.53
25	---	121	---	246	440	70	6.5	5.0	5.7	0.114	29.982	98.38	82.58
27	61	51	---	91	75	30	6.0	5.2	5.8	0.116	30.508	102.8	87.8
31	56	46	---	81	72	25	5.3	5.7	7.5	0.15	39.45	107.95	89.0
33	108	62	---	114	220	70	5.4	5.1	6.4	0.128	33.664	105.36	87.16
35	54	45	---	79	72	60	11.5	6.2	10.3	0.206	54.178	126.88	89.0
39	243	88	74	171	875	65	9.9	8.7	10.3	0.206	54.178	125.88	88.73
40	---	137	---	284	520	30	5.3	3.2	4.8	0.096	25.248	111.95	88.27
41	34	34	---	57	34	45	4.9	4.2	5.6	0.112	29.456	107.96	95.85
43	37	36	---	61	38	25	7.5	7.1	8.2	0.164	43.132	128.43	95.48
45	65	53	---	95	83	55	7.4	6.5	7.0	0.14	36.82	99.02	91.22
47	54	42	---	73	80	55	5.9	8.5	5.0	0.1	26.3	104.3	94.5
49	---	115	---	232	290	65	5.2	7.9	4.6	0.092	24.196	105.2	79.85
51	---	92	66	180	200	75	5.9	5.5	6.5	---	---	---	83.87
55	39	37	---	63	41	5	6.4	---	---	---	---	---	91.08
57	35	39	---	---	---	5	---	---	---	---	---	---	93.81
63	55	47	---	83	66	5	5.2	6.2	4.9	0.13	34.19	103.59	87.62
67	91	77	---	147	109	5	4.6	5.4	5.8	0.096	25.248	87.95	84.57
69	67	59	---	108	79	5	4.5	5.2	4.8	0.166	30.508	96.2	85.72
79	80	58	---	106	109	5	7.3	4.8	5.7	0.096	25.248	93.15	86.46
87	68	50	---	89	105	5	5.5	5.3	5.2	0.114	29.982	98.98	87.62
89	74	55	---	100	107	5	4.7	5.1	4.2	0.104	27.352	91.15	85.26
91	76	57	---	104	108	5	6.3	5.3	5.7	0.119	29.982	98.18	85.03
93	72	56	---	102	98	5	6.5	4.2	4.0	0.08	21.04	84.94	84.75
97	73	56	---	102	102	15	5.1	3.6	5.8	0.116	30.508	95.5	85.58
98	---	127	85	260	260	5	4.7	5.0	2.5	0.005	13.15	67.55	80.82
103	40	36	---	61	46	50	6.7	5.4	3.2	0.064	16.832	94.33	92.75
109	76	62	---	114	95	5	5.2	4.5	6.0	0.12	31.56	100.16	86.79
127	91	64	---	119	140	45	5.5	4.7	6.4	0.128	33.664	100.56	85.91
137	145	89	---	173	225	40	7.0	5.6	4.4	0.088	23.144	83.54	83.32
143	80	57	---	104	122	35	6.0	6.5	6.3	0.126	33.138	101.24	86.69

* Using the viscosity at 100°F in the equation VIS60 = 10**(10((log (log VIS100)) + 0.06)).
** Items taken from Reference 3.

12

●   Item K: % Gas Oil is the 620° to 1050°F cut of the crude. This value is
    calculated using a BETC-derived empirical correlation[5] between the
    787°F residue and data for the total percent off at 1050°F (experimental-
    ly determined for a limited set of oils).

    % Gas Oil = [(787°F residue)(-0.462202)] + 101.1145 - (% Naphtha + %
    Distillate)

    The correlation had a slope, y intercept, and standard error of -0.462202,
    101.1145, 1.21, respectively.

    Table 4 contains data for comparing total % off at 1050°F by linear
    extrapolation [based on the 737° and 787°F (atmospheric equivalent tem-
    perature) cuts] and by the BETC correlation. These data support the
    correlation approach as opposed to the extrapolation.

●   Item L: % Residuum is the part of the crude which, according to the gas
    oil correlation boils above 1050°F:
    % Residuum = 100 - [(787°F residue)(-0.462202)] + 101.1145.

    (Note: Distillate loss is not considered in calculations).

●   Item M: Location is a three-digit code indicating the source of the
    particular crude.

●   Item N: Field Name is the name of the oil field given by up to sixteen
    letters.

●   Item O: Comment is an 80-character field available for comments.

The computer program for converting the BETC data to SPRO search file data is
listed in Table 5. In the program, eight of the items are taken directly from
the BETC data, while the remaining seven items (B, G, H, I, J, K, and L)
require some modification to the BETC data as previously discussed.

13

Data for crude oil sample No. 69001 were chosen to provide a typical example of the crude oil data manipulation. Table 6 is a reproduction of a BETC crude petroleum analysis for this sample. Table 7 is the BETC data (from Table No. 6) for Sample No. 69001, arranged in the file format previously given in Table No. 2. Table 8 provides a listing (in the same order as in Table 3) of the computer program (Table 5) transformed values for crude oil Sample No. 69001. Table 9 is a file listing of the transformed data for crude oil Sample No. 69001 as it would be found in the SPRO Crude Oil Search File. The computer-transformed data were verified by manual calculation and were found to be within the reported significant figure limits.

For the purposes of illustration, the first 48 lines of the SPRO Crude Oil Search File have been reproduced in Table 10. To search the SPRO crude oil Search File, an individualized SPRO Search Program must be written for each particular crude oil search. An example of an SPRO Search Program is given in Table 11. The searching of the SPRO file is performed by reading in the data for each crude, rejecting any crude which does not conform to prespecified limits, and storing in a new file any crude which is not rejected. The search program in Table 11 was designed to find foreign crudes with an API gravity between 30 and 36, a sulfur content less than 1.99%, and a pour point of 50°F or lower.

Lines 1-4 and 205-209 in Table 11 are the required job control language (JCL) for the job. Lines 5-7, 198, and 199 read in each crude. Line 8 rejects the crude if it is not of foreign origin. Lines 9 and 10 reject the crude if its API gravity is not between 30 and 36. Lines 11 and 12 reject crudes with more than 1.99% sulfur. Line 13 rejects crudes with a pour point higher than 50°F. Lines 16-195 provide the name of the location corresponding to the location code. Table 12 is a correlation of the location code numbers with their respective locations. Finally, lines 14, 15, and 200-205 store any crude not rejected on file CN6086.RE5.JE.LOT6, which can then be output to a line printer.

Table 13 contains a partial listing from the line printer output of the file generated by the SPRO Search Program given in Table 11.

14

III. SUMMARY

Crude oil analysis data for the years 1950-1977 were obtained on magnetic tape from the DOE Bartlesville Energy Technology Center and placed on the DOE Energy Information Administration computer, for use by the Strategic Petroleum Reserve Office (SPRO). A data transformation program was written to convert the crude oil data to a new SPRO crude oil data file compatible with SPRO crude oil purchase specifications. The present SPRO search file must be searched through the use of specifically written search programs.

IV. REFERENCES

1. Frame, E.A., Owens, E.C., and Newman, F.M., "Crude Oil Characterization Data Program," Interim Report AFLRL No. 35, prepared by U.S. Army Fuels and Lubricants Research Laboratory, Southwest Research Institute, Government Accession No. AD A005076, July 1974.

2. McKinney, C.M., Ferrero, E.P., and Wenger, W.J., "Analyses of Crude Oils From 546 Important Oilfields for The United States," Report of Investigations 6819, U.S. Department of the Interior, Bureau of Mines, 1966.

3. Ferrero, E.P., and Nichols, D.T., "Analyses of 169 Crude Oils From 122 Foreign Oilfields," Information Circular 8542, Bartlesville Energy Research Center, Bartlesville, Oklahoma, 1972.

4. Bowden, J.N., and Stavinoha, L.L., "Final Report on Crude and Product Storage: State-of-the-Art Review and Assessment," AFLRL No. 110, prepared by U.S. Army Fuels and Lubricants Research Laboratory, Southwest Research Institute, Contract No. DAAK70-78-C-0001 and Interagency Agreement No. EL-78-A-01-2815, Government Accession No. AD A066605, November 1978.

5. Grizzle, P.L., Private communication, Bartlesville Energy Technology Center, Bartlesville, Oklahoma.

TABLE 5. TRANSFORMATION PROGRAM: BETC RAW DATA TO SPRO SEARCH FILE DATA

Line No.	Program Alpha-Numerics

```
 1.     //RESUWORK JOB (6086,D02),'EICHELBERGER,J.R.'
 2.     /*PHOLD
 3.     // EXEC FORTGCLG TIME=(5,5)
 4.     //FORT.SYSIN DD *
 5.            DIMENSION V(34),VOL(15),FIELD(4)
 6.     100    READ (8,10,END=20) XID,XNL,SPGC,SUL,F,PRPT,VIS100,CARB,
 7.            1(V(I),I=1,9),F,RESID,XCO,F,FIELD,IGEOL,F,F,(VOL(I),I=1,15),
 8.            1(V(I),I=1,34),VIS77
 9.            API=(141.5/SPGC)-131.4
10.            CRESD=RESID*(0-0.462202)+101.1145
11.            IF (CRESD.GT.100) CRESD=100
12.            RESID=100-CRESD
13.            VIS60=0
14.            IF (VIS100.EQ.0)GOTO 300
15.            VTEMP=(ALOG10(ALOG10(VIS100)))+.06
16.            VIS60=10.**(10.**VTEMP)
17.            IF (VIS77.EQ.0) GOTO 300
18.            C=.21587*VIS100-((11069*VIS100)/(VIS100**3+37003))
19.            C77=.21587*VIS77-((11069*VIS77)/(VIS77**3+37003))
20.            Z1=.7+C
21.            Z2=.7+C77
22.            B=(ALOG10(ALOG10(Z2))-ALOG10(ALOG10(Z1)))/(ALOG10(569.)-
23.            1ALOG10(592.))*(-1)
24.            A=ALOG10(ALOG10(Z1))+B*ALOG10(592.)
25.            C60=(10.**(10.**(A-B*ALOG10(552.))))-0.7
26.            VIS60=4.6324*C60+(1+.03264*C60)/(.039302+.002627*C60+
27.            1.0002397*C60**2+.00001646*C60**3)
28.            VIS60=VIS60*(1+.000061*(60-100))
29.     300    ASPH=4.9*CARB
30.            TEMP=(VOL(7)*28)/45
31.            TEM=(VOL(12)*2)/3
32.            PNAP=VOL(1)+VOL(2)+VOL(3)+VOL(4)+VOL(5)+VOL(6)+TEMP
33.            PDIS=TEM+VOL(11)+VOL(10)+VOL(9)+VOL(8)+VOL(7)-TEMP
34.            PGAS=CRESD-(PNAP+PDIS)
35.            IF (PRPT.LT.5) GOTO 88
36.            WRITE (9,11) XID,API,SUL,PRPT,VIS100,VIS77,VIS60,ASPH,
37.            1PNAP,PDIS,PGAS,RESID,XNL,FIELD
38.            GOTO 100
39.     88     PRPT=ABS(PRPT)
40.            WRITE (9,12) XID,API,SUL,PRPT,VIS100,VIS77,VIS60,ASPH,
41.            1PNAP,PDIS,PGAS,RESID,XNL,FIELD
42.            GOTO 100
43.     12     FORMAT (2X,F9.0,F9.1,F9.2,'          ('.F4.0,3F9.0,/,2X,5F9.1,
44.            12F9.0,/,2X,4A4,/)
45.     20     CONTINUE
46.     11     FORMAT (2X,F9.0,F9.1,F9.2,'          '.F4.0,3F9.0,/,2X,5F9.1,
47.            12F9.0,/,2X,4A4,/)
48.     10     FORMAT (10X,6F10.3,F10.0,/,2(10X,7F10.3,/),10X,4A4,10X,A4,
49.            110X,I10,10X,Z10,/,2(8X,8F9.3,/,17X,7F9.3,/),2(10X,7F10.3,/),
50.            110X,6F9.3,/)
51.            END
52.     /*
53.     //GO.FT08F001 DD DSN=CN6086.PRJ.BONTAPE.YR5077,UNIT=DASD,
54.     //         DISP=SHR
55.     //GO.FT09F001 DD DSN=CN6086.RES.SPRO.SFILE,UNIT=DASD,VOL=SER=FEA016,
56.     //         DISP=(NEW,CATLG),DCB=(RECFM=FB,LRECL=80,BLKSIZE=80),
57.     //         SPACE=(TRK,(100,100))
58.     //
```

TABLE 6. CRUDE PETROLEUM ANALYSIS DATA SHEET FOR SAMPLE NO. 69001

CRUDE PETROLEUM ANALYSIS

O-377 b
(April 1938)

Bureau of Mines .... Bartlesville .... Laboratory
Sample 69001

IDENTIFICATION

Burbank field
Layton and Burbank, Pennsylvanian
2,700 - 2,760 feet

Oklahoma
Osage County

GENERAL CHARACTERISTICS

Gravity, specific, 0.832　　Gravity, ° API, 38.6　　Pour point, ° F., below 5
Sulfur, percent, 0.20　　Color, brownish green
Viscosity, Saybolt Universal at 77°F, 51 sec.; 100°F, 43 sec.　　Nitrogen, percent, 0.049

DISTILLATION, BUREAU OF MINES ROUTINE METHOD

Stage 1—Distillation at atmospheric pressure, 744 mm. Hg

First drop, 77 ° F.

Fraction No.	Cut temp. °F.	Percent	Sum. percent	Sp. gr. 60/60° F.	° API 60° F.	C. I.	Refractive index, n_D at 20° C.	Specific dispersion	S. U. vise. 100° F.	Cloud test, °F.
1	122	1.4	1.4	0.633	92.0					
2	167	1.6	3.0	.674	78.4	9.4	1.37226	121.1		
3	212	3.5	6.5	.709	68.1	16	1.39673	126.6		
4	257	5.6	12.1	.734	61.3	19	1.40905	127.5		
5	302	5.3	17.4	.753	56.4	20	1.41983	131.1		
6	347	5.3	22.7	.772	51.8	22	1.42945	134.0		
7	392	5.5	28.2	.790	47.6	25	1.43852	135.2		
8	437	4.9	33.1	.804	44.5	26	1.44640	138.1		
9	482	5.4	38.5	.817	41.7	27	1.45386	141.9		
10	527	4.9	43.4	.828	39.4	27	1.46011	143.3		

Stage 2—Distillation continued at 40 mm. Hg

11	392	3.8	47.2	0.846	35.8	32	1.46771	144.1	40	10
12	437	6.3	53.5	.854	34.2	32	1.47119	148.8	46	30
13	482	6.1	59.6	.865	32.1	34	1.47811	153.8	58	55
14	527	5.5	65.1	.874	30.4	35			81	75
15	572	5.6	70.7	.882	28.9	36			135	90
Residuum		26.7	97.4	.923	21.8					

Carbon residue, Conradson: Residuum 3.1 percent; crude, 0.9 percent.

APPROXIMATE SUMMARY

	Percent	Sp. gr.	° API	Viscosity
Light gasoline	6.5	0.684	75.4	
Total gasoline and naphtha	28.2	0.744	58.7	
Kerosine distillate	10.3	.811	43.0	
Gas oil	13.9	.842	36.5	
Nonviscous lubricating distillate	11.9	.858–.877	33.5–29.9	50–100
Medium lubricating distillate	6.4	.877–.886	29.9–28.2	100–200
Viscous lubricating distillate	-	-	-	Above 200
Residuum	26.7	.923	21.8	
Distillation loss	2.6			

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TABLE 7.   CRUDE OIL RAW DATA FILE FOR SAMPLE NO. 69001

File Line No.	File Alpha-Numerics					
13577.	69001.000	35.000	0.832	0.200	0.049	−5.000
13578.	0.909	0.000	0.000	6.500	23.200	10.300
13579.	11.886	6.397	0.000	2.600	26.700	113.000
13580.	BURBANK		CMPS		0	
13581.	1.400	1.600	3.500	5.600	5.300	5.300	5.500
13582.		5.400	4.900	3.800	6.300	6.100	5.500
13583.	0.633	0.674	0.709	0.734	0.753	0.772	0.790
13584.		0.817	0.828	0.846	0.854	0.865	0.874
13585.	0.923	40.000	46.000	53.000	81.000	135.000
13586.	30.000	55.000	75.000	90.000	.0.634	0.744
13587.	0.842	0.853	0.877	0.886	0.000	51.000
13588.						

TABLE 8.   SPRO SEARCH FILE – COMPUTER CALCULATED DATA
CRUDE OIL SAMPLE 69001

Item	Description	Alpha-Numeric Data
A	Sample Identification	69001.
B	API° Gravity at 60°F	38.7
C	Wt % Sulfur	0.20
D	Pour Point, °F	5.
E	SUS Viscosity at 100°F	43.
F	SUS Viscosity at 77°F	51.
G	SUS Viscosity at 60°F	61.
H	Wt% est. Asphalt	4.4
I	% Naphtha	26.1
J	% Distillate	25.3
K	% Gas Oil	37.4
L	% Residuum	11.2
M	Location Code	35.
N	Field Name	Burbank
O	Comment	(Blank)

TABLE 9.   DATA FOR CRUDE OIL SAMPLE NO. 69001 IN THE
SPRO CRUDE OIL SEARCH FILE

File Line No.	File Alpha-Numerics						
11143.	69001.	38.7	0.20	< 5.	43.	51.	61.
11144.	4.4	26.1	25.3	37.4	11.2	35.	
11145.	BURBANK						
11146.							

18

TABLE 10. REPRODUCTION OF 48 LINES IN THE SPRO SEARCH FILE

File Line No.	Crude Oil File Alpha-Numerics						
709.	51028.	30.3	1.46	20.	60.	33.	117.
710.	26.9	23.3	22.0	39.3	14.9	61.	
711.	STETTLER						
712.							
713.	51029.	33.5	1.09	20.	52.	65.	32.
714.	19.1	25.0	21.7	40.4	13.0	61.	
715.	BIG VALLEY						
716.							
717.	51030.	34.3	0.71	35.	49.	0.	87.
718.	14.2	25.7	22.5	39.5	12.3	61.	
719.	BIG VALLEY						
720.							
721.	51031.	41.4	0.19	< 5.	39.	0.	67.
722.	3.9	32.3	26.5	31.6	9.1	35.	
723.	GOLDEN TREND OMA						
724.							
725.	51032.	43.7	0.21	< 5.	38.	0.	65.
726.	3.4	34.6	25.7	31.6	3.0	35.	
727.	MAYSVILLE.S						
728.							
729.	51033.	38.9	0.35	15.	41.	0.	71.
730.	9.3	31.7	26.4	32.4	9.5	35.	
731.	MAYSVILLE.SE						
732.							
733.	51034.	39.7	0.22	5.	41.	0.	71.
734.	7.9	30.0	25.7	34.3	10.0	35.	
735.	GOLDSBY.SW						
736.							
737.	51035.	20.4	0.37	< 5.	530.	0.	1342.
738.	9.8	0.0	26.9	53.7	19.4	35.	
739.	HOOVER.N						
740.							
741.	51036.	45.0	0.24	< 5.	38.	0.	65.
742.	5.4	42.2	23.7	27.0	7.1	35.	
743.	MAYSVILLE.S						
744.							
745.	51037.	20.4	0.44	< 5.	670.	0.	1757.
746.	9.3	0.0	23.9	55.3	20.8	50.	
747.	SIMPSON						
748.							
749.	51038.	32.2	0.22	< 5.	59.	75.	35.
750.	10.3	18.5	27.0	40.7	13.8	35.	
751.	QUAPAW						
752.							
753.	51039.	32.9	0.23	< 5.	55.	83.	136.
754.	9.8	20.5	27.4	39.0	13.1	35.	
755.	QUAPAW						
756.							

TABLE 11. A SPRO SEARCH PROGRAM

File Line No.	Program Alpha-Numerics

```
  1.     //RESULOOK  JOB  (6086,D02),'EICHELBERGER,J.R.'
  2.     /*PHOLD
  3.     // EXEC FORTGCLG
  4.     //FORT.SYSIN DD *
  5.            DIMENSION FIELD(4),SIGN(3)
  6.     300    READ (8,10,END=20) XID,API,SUL,SIGN,PRPT,VIS100,VIS77,VIS60,
  7.           1ASPH,PNAP,PDIS,PGAS,RESID,XML,FIELD
  8.            IF(XML.LT.51)GOTO 300
  9.            IF(API.LT.30)GOTO 300
 10.            IF(API.GT.36)GOTO 300
 11.            RLIM=1.99
 12.            IF(SUL.GT.RLIM)GOTO 300
 13.            IF(PRPT.GT.50)GOTO 300
 14.            WRITE (9,11) XID,API,SUL,SIGN,PRPT,VIS100,VIS77,VIS60,ASPH,
 15.           1PNAP,PDIS,PGAS,RESID,XML,FIELD
 16.            IF(XML.EQ.1)WRITE(9,1)
 17.            IF(XML.EQ.2)WRITE(9,2)
 18.            IF(XML.EQ.3)WRITE(9,3)
 19.            IF(XML.EQ.4)WRITE(9,4)
 20.            IF(XML.EQ.5)WRITE(9,5)
 21.            IF(XML.EQ.9)WRITE(9,9)
 22.            IF(XML.EQ.12)WRITE(9,12)
 23.            IF(XML.EQ.13)WRITE(9,13)
 24.            IF(XML.EQ.15)WRITE(9,15)
 25.            IF(XML.EQ.16)WRITE(9,16)
 26.            IF(XML.EQ.17)WRITE(9,17)
 27.            IF(XML.EQ.21)WRITE(9,21)
 28.            IF(XML.EQ.23)WRITE(9,23)
 29.            IF(XML.EQ.24)WRITE(9,24)
 30.            IF(XML.EQ.25)WRITE(9,25)
 31.            IF(XML.EQ.26)WRITE(9,26)
 32.            IF(XML.EQ.27)WRITE(9,27)
 33.            IF(XML.EQ.30)WRITE(9,30)
 34.            IF(XML.EQ.31)WRITE(9,31)
 35.            IF(XML.EQ.33)WRITE(9,33)
 36.            IF(XML.EQ.34)WRITE(9,34)
 37.            IF(XML.EQ.35)WRITE(9,35)
 38.            IF(XML.EQ.37)WRITE(9,37)
 39.            IF(XML.EQ.40)WRITE(9,40)
 40.            IF(XML.EQ.41)WRITE(9,41)
 41.            IF(XML.EQ.42)WRITE(9,42)
 42.            IF(XML.EQ.43)WRITE(9,43)
 43.            IF(XML.EQ.45)WRITE(9,45)
 44.            IF(XML.EQ.46)WRITE(9,46)
 45.            IF(XML.EQ.47)WRITE(9,47)
 46.            IF(XML.EQ.49)WRITE(9,49)
 47.            IF(XML.EQ.50)WRITE(9,50)
 48.            IF(XML.EQ.55)WRITE(9,55)
 49.            IF(XML.EQ.61)WRITE(9,61)
 50.            IF(XML.EQ.62)WRITE(9,62)
 51.            IF(XML.EQ.63)WRITE(9,63)
 52.            IF(XML.EQ.64)WRITE(9,64)
 53.            IF(XML.EQ.65)WRITE(9,65)
 54.            IF(XML.EQ.66)WRITE(9,66)
 55.            IF(XML.EQ.68)WRITE(9,68)
 56.            IF(XML.EQ.70)WRITE(9,70)
 57.            IF(XML.EQ.71)WRITE(9,71)
 58.            IF(XML.EQ.72)WRITE(9,72)
 59.            IF(XML.EQ.73)WRITE(9,73)
 60.            IF(XML.EQ.74)WRITE(9,74)
 61.            IF(XML.EQ.75)WRITE(9,75)
 62.            IF(XML.EQ.76)WRITE(9,76)
 63.            IF(XML.EQ.77)WRITE(9,77)
 64.            IF(XML.EQ.78)WRITE(9,78)
 65.            IF(XML.EQ.79)WRITE(9,79)
 66.            IF(XML.EQ.80)WRITE(9,80)
 67.            IF(XML.EQ.81)WRITE(9,81)
 68.            IF(XML.EQ.82)WRITE(9,82)
 69.            IF(XML.EQ.83)WRITE(9,83)
 70.            IF(XML.EQ.84)WRITE(9,84)
 71.            IF(XML.EQ.85)WRITE(9,85)
 72.            IF(XML.EQ.86)WRITE(9,86)
```

TABLE 11. A SPRO SEARCH PROGRAM (Cont'd)

File Line No.		Program Alpha-Numerics
73.		IF (XNL.EQ.87)WRITE (9,87)
74.		IF (XNL.EQ.88)WRITE (9,88)
75.		IF (XNL.EQ.89)WRITE (9,89)
76.		IF (XNL.EQ.90)WRITE (9,90)
77.		IF (XNL.EQ.91)WRITE (9,91)
78.		IF (XNL.EQ.92)WRITE (9,92)
79.		IF (XNL.EQ.93)WRITE (9,93)
80.		IF (XNL.EQ.94)WRITE (9,94)
81.		IF (XNL.EQ.95)WRITE (9,95)
82.		IF (XNL.EQ.96)WRITE (9,96)
83.		IF (XNL.EQ.97)WRITE (9,97)
84.		IF (XNL.EQ.98)WRITE (9,98)
85.		IF (XNL.EQ.99)WRITE (9,99)
86.		IF (XNL.EQ.100)WRITE (9,100)
87.		IF (XNL.EQ.101)WRITE (9,101)
88.		IF (XNL.EQ.102)WRITE (9,102)
89.		IF (XNL.EQ.103)WRITE (9,103)
90.		IF (XNL.EQ.104)WRITE (9,104)
91.		IF (XNL.EQ.105)WRITE (9,105)
92.		IF (XNL.EQ.106)WRITE (9,106)
93.		IF (XNL.EQ.107)WRITE (9,107)
94.		IF (XNL.EQ.108)WRITE (9,108)
95.		IF (XNL.EQ.109)WRITE (9,109)
96.		IF (XNL.EQ.110)WRITE (9,110)
97.		IF (XNL.EQ.111)WRITE (9,111)
98.		IF (XNL.EQ.112)WRITE (9,112)
99.		IF (XNL.EQ.113)WRITE (9,113)
100.		IF (XNL.EQ.114)WRITE (9,114)
101.		IF (XNL.EQ.115)WRITE (9,115)
102.		IF (XNL.EQ.116)WRITE (9,116)
103.		IF (XNL.EQ.117)WRITE (9,117)
104.		IF (XNL.EQ.118)WRITE (9,118)
105.		IF (XNL.EQ.119)WRITE (9,119)
106.	1	FORMAT (2X,'LOCATION IS ALABAMA ')
107.	2	FORMAT (2X,'LOCATION IS ARIZONA ')
108.	3	FORMAT (2X,'LOCATION IS ARKANSAS')
109.	4	FORMAT (2X,'LOCATION IS CALIFORN')
110.	5	FORMAT (2X,'LOCATION IS COLORADO')
111.	9	FORMAT (2X,'LOCATION IS FLORIDA ')
112.	12	FORMAT (2X,'LOCATION IS ILLINOIS')
113.	13	FORMAT (2X,'LOCATION IS INDIANA ')
114.	15	FORMAT (2X,'LOCATION IS KANSAS ')
115.	16	FORMAT (2X,'LOCATION IS KENTUCKY')
116.	17	FORMAT (2X,'LOCATION IS LOUISIAN')
117.	21	FORMAT (2X,'LOCATION IS MICHIGAN')
118.	23	FORMAT (2X,'LOCATION IS MISSISSI')
119.	24	FORMAT (2X,'LOCATION IS MISSOURI')
120.	25	FORMAT (2X,'LOCATION IS MONTANA ')
121.	26	FORMAT (2X,'LOCATION IS NEBRASKA')
122.	27	FORMAT (2X,'LOCATION IS NEVADA ')
123.	30	FORMAT (2X,'LOCATION IS NEW MEXI')
124.	31	FORMAT (2X,'LOCATION IS NEW YORK')
125.	33	FORMAT (2X,'LOCATION IS NORTH DA')
126.	34	FORMAT (2X,'LOCATION IS OHIO ')
127.	35	FORMAT (2X,'LOCATION IS OKLAHOMA')
128.	37	FORMAT (2X,'LOCATION IS PENNSYLV')
129.	40	FORMAT (2X,'LOCATION IS SOUTH DA')
130.	41	FORMAT (2X,'LOCATION IS TENNESSE')
131.	42	FORMAT (2X,'LOCATION IS TEXAS ')
132.	43	FORMAT (2X,'LOCATION IS UTAH ')
133.	45	FORMAT (2X,'LOCATION IS VIRGINIA')
134.	46	FORMAT (2X,'LOCATION IS WASHINGT')
135.	47	FORMAT (2X,'LOCATION IS WEST VIR')
136.	49	FORMAT (2X,'LOCATION IS WYOMING ')
137.	50	FORMAT (2X,'LOCATION IS ALASKA ')
138.	61	FORMAT (2X,'LOCATION IS ALBERTA ')
139.	62	FORMAT (2X,'LOCATION IS BRITISH ')
140.	63	FORMAT (2X,'LOCATION IS MANITOBA')
141.	64	FORMAT (2X,'LOCATION IS NEW BRUN')
142.	65	FORMAT (2X,'LOCATION IS NEWFOUND')
143.	66	FORMAT (2X,'LOCATION IS NORTHWES')
144.	68	FORMAT (2X,'LOCATION IS ONTARIO ')

TABLE 11. A SPRO SEARCH PROGRAM (Cont'd)

File Line No.		Program Alpha-Numerics
145.	70	FORMAT(2X,'LOCATION IS QUEBEC ')
146.	71	FORMAT(2X,'LOCATION IS SASKATCH')
147.	72	FORMAT(2X,'LOCATION IS ALGERIA ')
148.	73	FORMAT(2X,'LOCATION IS ANGOLA ')
149.	74	FORMAT(2X,'LOCATION IS EGYPT ')
150.	75	FORMAT(2X,'LOCATION IS GABON ')
151.	76	FORMAT(2X,'LOCATION IS LIBYA ')
152.	77	FORMAT(2X,'LOCATION IS MADAGASC')
153.	78	FORMAT(2X,'LOCATION IS MOROCCO ')
154.	79	FORMAT(2X,'LOCATION IS NIGERIA ')
155.	80	FORMAT(2X,'LOCATION IS ABU DHAB')
156.	81	FORMAT(2X,'LOCATION IS BAHREIN ')
157.	82	FORMAT(2X,'LOCATION IS INDIA ')
158.	83	FORMAT(2X,'LOCATION IS BORNEO ')
159.	84	FORMAT(2X,'LOCATION IS JAVA ')
160.	85	FORMAT(2X,'LOCATION IS SUMATRA ')
161.	86	FORMAT(2X,'LOCATION IS IRAN ')
162.	87	FORMAT(2X,'LOCATION IS IRAQ ')
163.	88	FORMAT(2X,'LOCATION IS ISRAEL ')
164.	89	FORMAT(2X,'LOCATION IS JAPAN ')
165.	90	FORMAT(2X,'LOCATION IS KUWAIT ')
166.	91	FORMAT(2X,'LOCATION IS PAKISTAN')
167.	92	FORMAT(2X,'LOCATION IS PALESTIN')
168.	93	FORMAT(2X,'LOCATION IS QATAR ')
169.	94	FORMAT(2X,'LOCATION IS SAUDI AR')
170.	95	FORMAT(2X,'LOCATION IS TAIWAN ')
171.	96	FORMAT(2X,'LOCATION IS THAILAND')
172.	97	FORMAT(2X,'LOCATION IS ALBANIA ')
173.	98	FORMAT(2X,'LOCATION IS CZECHOSL')
174.	99	FORMAT(2X,'LOCATION IS POLAND ')
175.	100	FORMAT(2X,'LOCATION IS RUMANIA ')
176.	101	FORMAT(2X,'LOCATION IS USSR ')
177.	102	FORMAT(2X,'LOCATION IS AUSTRALI')
178.	103	FORMAT(2X,'LOCATION IS FRANCE ')
179.	104	FORMAT(2X,'LOCATION IS GERMANY ')
180.	105	FORMAT(2X,'LOCATION IS GREECE ')
181.	106	FORMAT(2X,'LOCATION IS ITALY ')
182.	107	FORMAT(2X,'LOCATION IS NETHERLA')
183.	108	FORMAT(2X,'LOCATION IS NORWAY ')
184.	109	FORMAT(2X,'LOCATION IS NEW ZEAL')
185.	110	FORMAT(2X,'LOCATION IS UNITED K')
186.	111	FORMAT(2X,'LOCATION IS MEXICO ')
187.	112	FORMAT(2X,'LOCATION IS ARGENTIN')
188.	113	FORMAT(2X,'LOCATION IS CHILE ')
189.	114	FORMAT(2X,'LOCATION IS COLOMBIA')
190.	115	FORMAT(2X,'LOCATION IS EQUADOR ')
191.	116	FORMAT(2X,'LOCATION IS PERU ')
192.	117	FORMAT(2X,'LOCATION IS VENEZUEL')
193.	118	FORMAT(2X,'LOCATION IS CUBA ')
194.	119	FORMAT(2X,'LOCATION IS TRINIDAD')
195.	55	FORMAT(2X,'LOCATION IS UNKNOWN')
196.		GOTO 300
197.	20	CONTINUE
198.	10	FORMAT (2X,F9.0,F9.1,F9.2,3A2,F4.0,3F9.0,/,2X,5F9.1,
199.		1F9.0,/,2X,4A4,/)
200.	11	FORMAT (//,2X,' CRUDE ID API SULPHUR POUR PT SUS 100 ',
201.		1 SUS 77 SUS 60 ',/,2X,F9.0,F9.1,F9.2,3A2,F4.0,3F9.0,/,
202.		12X,'% ASPHALT % NAPHTH % DISTL %GAS OIL % RESID LOC CODE',
203.		1 ,2X,5F9.1,F9.0,/,2X,'FIELD IS ',4A4,' ',8A1,/)
204.		END
205.		//GO.FT09F001 DD DSN=CN6086.RES.SPRO.SFILE,UNIT=DASD,DISP=SHR
206.		//GO.FT09F001 DD DSN=CN6086.RES.JE.LOT6,UNIT=DASD,VOL=SER=FEA016,
207.		// DISP=(NEW,CATLG),DCB=(RECFM=FB,LRECL=80,BLKSIZE=80,
208.		// SPACE=(TRK,(50,50))
209.		//

TABLE 12. LISTING OF LOCATION CODE NUMBERS AND LOCATIONS

Location Code No.		Location	Location Code No.		Location
1.	1	ALABAMA	46.	75	GBABON
2.	2	ARIZONA	47.	76	LIBYA
3.	3	ARKANSAS	48.	77	MADAGASC
4.	4	CALIFORN	49.	78	MOROCCO
5.	5	COLORADO	50.	79	NIGERIA
6.	9	FLORIDA	51.	80	ABU DHAB
7.	12	ILLINOIS	52.	81	BAHREIN
8.	13	INDIANA	53.	82	INDIA
9.	15	KANSAS	54.	83	BORNEO
10.	16	KENTUCKY	55.	84	JAVA
11.	17	LOUISIAN	56.	85	SUMATRA
12.	21	MICHIGAN	57.	86	IRAN
13.	23	MISSISSI	58.	87	IRAQ
14.	24	MISSOURI	59.	88	ISRAEL
15.	25	MONTANA	60.	89	JAPAN
16.	26	NEBRASKA	61.	90	KUWAIT
17.	27	NEVADA	62.	91	PAKISTAN
18.	30	NEW MEXI	63.	92	PALESTIN
19.	31	NEW YORK	64.	93	QATAR
20.	33	NORTH DA	65.	94	SAUDI AR
21.	34	OHIO	66.	95	TAIWAN
22.	35	OKLAHOMA	67.	96	THAILAND
23.	37	PENNSYLV	68.	97	ALBANIA
24.	40	SOUTH DA	69.	98	CZECHOSL
25.	41	TENNESSE	70.	99	POLAND
26.	42	TEXAS	71.	100	RUMANIA
27.	43	UTAH	72.	101	USSR
28.	45	VIRGINIA	73.	102	AUSTRALI
29.	46	WASHINGT	74.	103	FRANCE
30.	47	WEST VIR	75.	104	GERMANY
31.	49	WYOMING	76.	105	GREECE
32.	50	ALASKA	77.	106	ITALY
33.	55	UNKNOWN	78.	107	NETHERLA
34.	61	ALBERTA	79.	108	NORWAY
35.	62	BRITISH	80.	109	NEW ZEAL
36.	63	MANITOBA	81.	110	UNITED K
37.	64	NEW BRUN	82.	111	MEXICO
38.	65	NEWFOUND	83.	112	ARGENTIN
39.	66	NORTHWES	84.	113	CHILE
40.	68	ONTARIO	85.	114	COLOMBIA
41.	70	QUEBEC	86.	115	EQUADOR
42.	71	SASKATCH	87.	116	PERU
43.	72	ALGERIA	88.	117	VENEZUEL
44.	73	ANGOLA	89.	118	CUBA
45.	74	EGYPT	90.	119	TRINIDAD

TABLE 13. PARTIAL LISTING OF CRUDE OIL IDENTIFICATIONS AND DATA FOR A PARTICULAR SPRO SEARCH PROGRAM

Line No.	Crude Oil Data
1.	
2.	CRUDE ID API SULPHUR POUR PT SUS 100 SUS 77 SUS 60
3.	50070. 33.5 1.80 < 5. 43. 0. 75.
4.	% ASPHALT % NAPHTH % DISTL %GAS OIL % RESID LOC CODE
5.	16.2 32.0 23.9 33.2 10.9 55.
6.	FIELD IS
7.	LOCATION IS UNKNOWN
8.	
9.	CRUDE ID API SULPHUR POUR PT SUS 100 SUS 77 SUS 60
10.	51029. 30.3 1.46 20. 60. 83. 117.
11.	% ASPHALT % NAPHTH % DISTL %GAS OIL % RESID LOC CODE
12.	26.9 23.3 22.0 39.8 14.9 61.
13.	FIELD IS STETTLER
14.	LOCATION IS ALBERTA
15.	
16.	CRUDE ID API SULPHUR POUR PT SUS 100 SUS 77 SUS 60
17.	51029. 33.5 1.09 20. 52. 65. 82.
18.	% ASPHALT % NAPHTH % DISTL %GAS OIL % RESID LOC CODE
19.	19.1 25.0 21.7 40.4 13.0 61.
20.	FIELD IS BIG VALLEY
21.	LOCATION IS ALBERTA
22.	
23.	CRUDE ID API SULPHUR POUR PT SUS 100 SUS 77 SUS 60
24.	51030. 34.3 0.71 35. 49. 0. 87.
25.	% ASPHALT % NAPHTH % DISTL %GAS OIL % RESID LOC CODE
26.	14.2 25.7 22.5 39.5 12.3 61.
27.	FIELD IS BIG VALLEY
28.	LOCATION IS ALBERTA
29.	
30.	CRUDE ID API SULPHUR POUR PT SUS 100 SUS 77 SUS 60
31.	51068. 33.1 0.89 < 5. 45. 0. 79.
32.	% ASPHALT % NAPHTH % DISTL %GAS OIL % RESID LOC CODE
33.	13.2 27.5 26.1 35.3 11.1 61.
34.	FIELD IS CAMPBELL
35.	LOCATION IS ALBERTA
36.	
37.	CRUDE ID API SULPHUR POUR PT SUS 100 SUS 77 SUS 60
38.	52005. 31.6 0.71 45. 71. 0. 134.
39.	% ASPHALT % NAPHTH % DISTL %GAS OIL % RESID LOC CODE
40.	19.6 18.4 24.3 42.4 14.8 104.
41.	FIELD IS SUDERBRUCH
42.	LOCATION IS GERMANY
43.	
44.	CRUDE ID API SULPHUR POUR PT SUS 100 SUS 77 SUS 60
45.	52026. 30.5 0.80 < 5. 54. 74. 106.
46.	% ASPHALT % NAPHTH % DISTL %GAS OIL % RESID LOC CODE
47.	30.4 26.8 24.0 36.4 12.8 117.
48.	FIELD IS OFICINA (HEAVY)
49.	LOCATION IS VENEZUEL

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